E-T-A®
ENGINEERING TECHNOLOGY

User Manual

ControlPlex® Controller CPC10PN

PROFINET®

Contents

2 General information 4
2.1 Safety instructions 4
2.2 Qualified personnel 4
2.3 Use 4
2.4 Delivery state 4
3 General description 5
3.1 Design of the entire system 6
3.2 Dimensions of version CPC10PN-T1 7
3.3 Dimensions of version CPC10PN-T4 8
3.4 Status indication and terminals 8
3.4.1 Terminals for voltage supply 8
3.4.2 Connector socket for the ***ELBus***®, connector sockets X51, X52, X53, X54 8
3.4.3 USB service interface, terminals X61 9
3.4.4 Bus interfaces to PROFINET, connector socket X81, X82 9
3.4.5 LED PWR 9
3.4.6 LED CE 9
3.4.7 LED CM 9
3.4.8 LED MS 9
3.4.9 LED NS 9
3.4.10 LED X81 A and X82 A 9
3.4.11 LED X81 B and X82 B 9
4 Mounting and installation 10
4.1 Mounting of the system 10
4.2 Wiring and connecting the modules 10
4.2.1 Supply of terminal strip X41 10
4.2.2 ***ELBus*®** connector sockets to power distribution system (-X51, -X52, -X53, -X54) ... 11
4.2.3 USB service and maintenance interface (-X61) 12
4.2.4 PROFINET interface withj integral switch (-X81, -X82) 12
5 Operating modes of the CPC10PN controller 12
5.1 Operating mode: Start-up mode 12
5.2 Operating mode: System error mode 12
5.3 Operating mode: Configuration error mode 12
5.4 Operating mode: Stand-alone mode 12
5.5 Operating mode: Slave mode 13
5.6 Operating mode: Firmware update mode 13
5.7 Signalling of the various operating modes 13
6 Basic functions of the entire system 14
6.1 Internal cycle times 14
6.2 Hot swap of circuit protectors 14
6.3 Communication via the USB service interface 15
7 Communication via PROFINET 15
7.1 ***ControlPlex*®** model 15/16
7.2 GSDML file 17
7.3 I&M - data (identification & maintenance) 17

8 Cyclical I/O data 18
8.1 Module I/O data CPC10PN controller 18
8.2 Submodule Status/Control 19
8.2.1 Status circuit protector 19
8.2.2 Control circuit protector 20
8.3 Submodule measuring values 20
8.3.1 Load current circuit protector 21
8.3.2 Load voltage circuit protector 21
8.4 Submodule total current 21
9 Non-cyclical data 22
9.1 Configuration data CPC10PN controller 23
9.2 Configuration data slot for circuit protector 24
9.3 Device information CPC10PN controller 25
9.3.1 Device type 25
9.3.2 Serial number 26
9.3.3 Hardware version 26
9.3.4 Software version 27
9.4 Device information circuit protector 27
9.4.1 Type 27
9.4.2 Serial number 28
9.4.3 Hardware version 28
9.4.4 Software version 29
9.5 Device parameters circuit protector 29
9.5.1 Current rating 29
9.5.2 Switch-on behaviour 30
9.5.3 Overload disconnection 30
9.5.4 Trip time at overload 30
9.5.5 Trip time at short circuit 31
9.5.6 ON delay 31
9.5.7 Limit value load current 31
9.5.8 Hysteresis of the limit value 32
9.6 Action commands circuit protector 32
9.7 Event messages circuit protector 33
9.8 Diagnostic messages circuit protector 33
9.8.1 Error memory 33
9.8.2 Trip counter 34
9.8.3 Reason for trip 34
9.8.4 Operating voltage 34
9.8.5 Temperature 35
9.8.6 Internal communication messages 35
9.9 Bar chart circuit protector 36
10 Appendix 37
10.1 List of pictures 37
10.2 Technical data 38
10.3 Subject index 38

2 General information

2.1 Safety instructions

This manual points out possible danger for your personal safety and gives instruction how to avoid property damage. The following safety symbols are used to draw the reader's attention to the safety instructions included in this manual.

Danger!
There is a threat to life or health
unless the following safety measures are observed.

Caution!
Machinery, materials or the environment might get damaged
unless the following safety measures are observed.

Note
Information is provided to allow a better understanding.

Caution:
Electrostatically sensitive devices (ESD).
Devices must exclusively be opened by the manufacturer.

Waste management guidelines
Packaging can be recycled and should generally be
brought to re-use.

2.2 Qualified personnel

This user manual must exclusively be used by qualified personnel, who are able - based on their training and experience - to realise arising problems when handling the product and to avoid related hazards. These persons have to ensure that the use of the product described here meets the safety requirements as well as the requirements of the presently valid directives, standards and laws.

2.3 Use

The product is part of a continuous enhancement process. Therefore there might be deviations between the product in hand and this documentation. These deviations will be remedied by a regular review and resulting corrections in future editions. The right to make changes without notice is reserved. Error and omissions excepted.

2.4 Delivery state

The product is supplied with a defined hardware and software configuration. Any changes in excess of the documented options are not permitted and lead to liability exclusion.

3 General description

Modern factory automation and process control have ever more complex and sophisticated requirements. Control is no longer the sole focus, but monitoring of components and processes becomes more and more important. This is exactly the target application area of the intelligent and bus-capable power distribution system ***ControlPlex***®. It serves for the protection of industrial applications as well for monitoring and control. The bus controller CPC10PB is the core of the system and provides the data exchange between superordinate and subordinate components. These are on the one hand programmable control units and on the other hand it is the power distribution system SVS201-PWR-xx, fitted with the electronic circuit protectors ESX50D-S1-xx. The bus controller CPC10PN can be connected with four independent power distribution systems SVS201-PWR-xx and offers the possibility of communication with up to 96 electronic circuit protectors. Communication options comprise transmission of the operating condition, of measuring values and device information regarding the connected components, but also changes of the product-specific parameters such as current ratings and execution of actions, e.g. ON and OFF operation.

Information can be transmitted in a cyclical or non-cyclical mode to the superordinate control system or via an available service interface to the connected service computer. If no connection is available to a superordinate control unit, this will have no effect on the behaviour of the connected circuit protectors. The bus controller is able to ensure their functionality even without a connection to a superordinate control unit. The saved parameters will be used for this purpose.

The bus-capable power distribution system ***ControlPlex***® offers the well-known E-T-A quality and reliability with regard to overcurrent protection in combination with the innovative functions on the score of automation technology.

3.1 Design of the entire system

The core of the ***ControlPlex®*** system is the bus controller CPC10PN-Tx. Thanks to its interfaces, it allows a consistent communication between the power distribution systems SVS201-PWR-xx with the plugged-in electronic circuit protectors ESX50D-S1xx and the superordinate control units as well as the service computer.

The PROFINET interface to the superordinate control unit features a 2-Port RJ45 connector. It allows connection of the required control unit with the ControlPlex® system, thus enabling display and analysis of the individual measuring values as well as diagnosis and control of the individual electronic circuit protectors. The same functions are also made available at the USB service interface. Should there be any changes in the automation system, all required measuring values of the electronic circuit protectors can be observed by means of the service interface and, if this functionality has been released by the superordinate control unit, they can be adjusted to the device parameters. This enables the user to have unrestricted access to the safety-relevant functions even in the event of an interruption. Any occurring failures will be detected quickly and can be remedied without delay. The CP system effectively reduces system downtimes and significantly increases productivity.

The interface to the up to four power distribution boards SVS201-PWR-xx is realised with local bus defined specially in-house at E-T-A called ***ELBus®*** . It transmits all cyclical and non-cyclical data in a cycle time of 230 - 730 milliseconds (depending on the version of the up to four power distribution boards SVS201-PWR-xx). The power boards are mutually independent and are addressed in parallel by the communication unit. Each specific version of the power distribution board SVS201-PWR-xx can be selected by the customers in available slot numbers of four, eight, twelve, sixteen and twenty-four electronic circuit protectors.

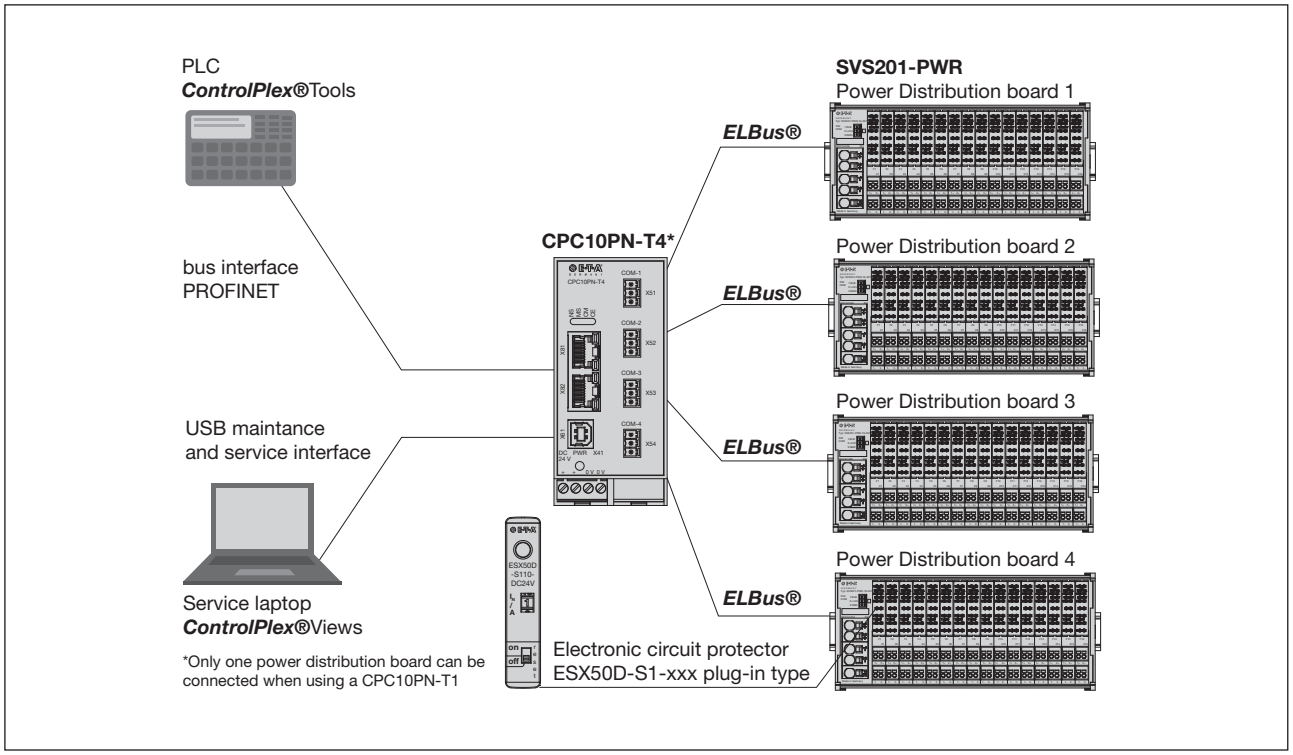


fig. 1: System overview

3.2 Dimensions of version CPC10PN-T1

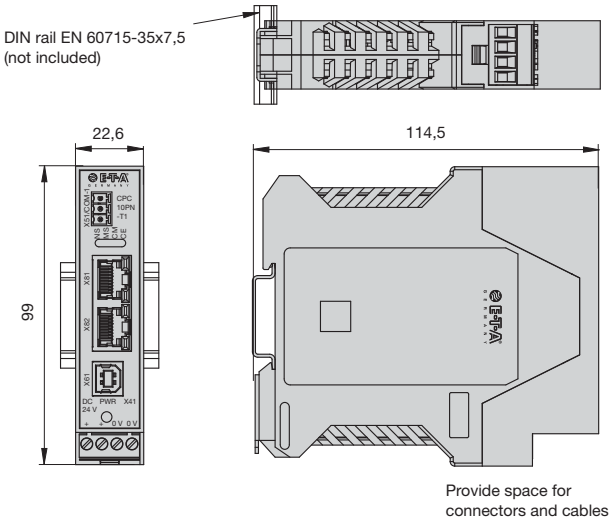


fig. 2: CPC10PN-T1 (1-Port)

3.3 Dimensions of version CPC10PN-T4

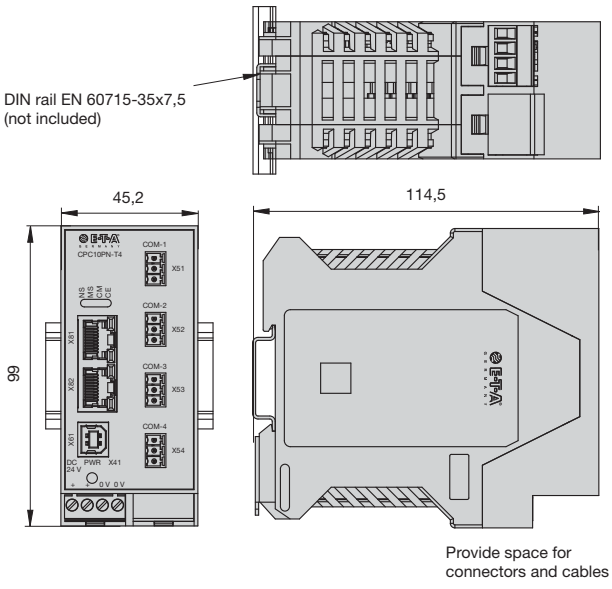


fig. 3: CPC10PN-T4 (4-Port)

3.4 Status indication and terminals

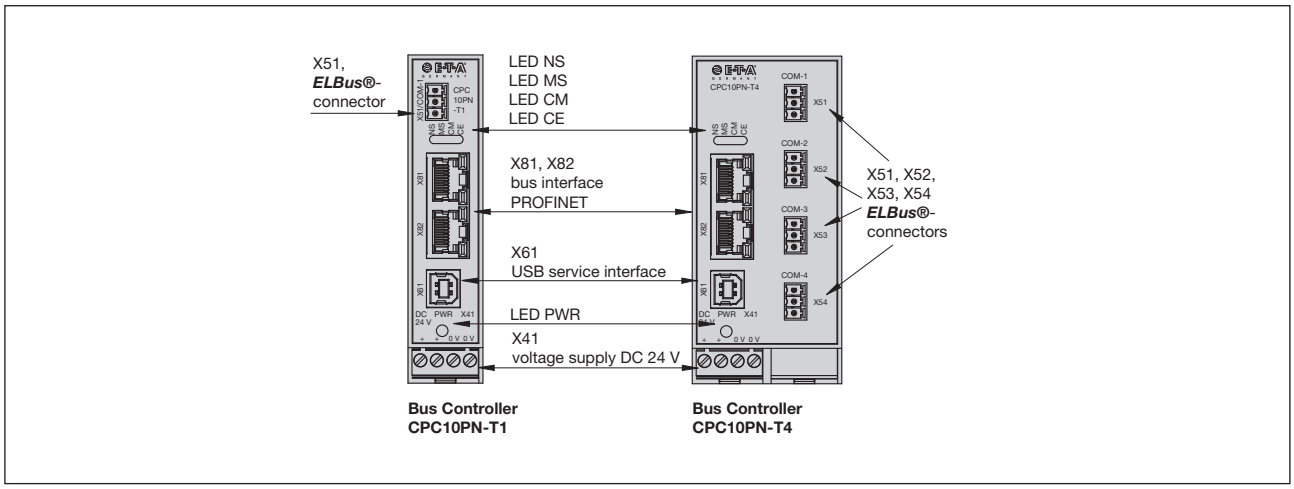


fig. 4: Status indication and terminals CPC10PN-Tx

3.4.1 Terminals for voltage supply

The operating voltage of the device is 24 V DC. Faultless operation of the device is ensured in a voltage range of 18 V to 32 V. Current consumption on duty is typically 60 mA.

Using a supply voltage outside the indicated operating range can cause malfunctions or destruction of the device.

3.4.2 Connector socket for the *ELBus*®, connector sockets X51, X52, X53, X54

These connector sockets serve for connecting the communication unit CPC10 with up to four power distribution boards SVS201-PWR-xx. Connection of the devices is realised with a one-to-one wiring mode. Preferably it shall be realised with a cable type H07V-K 1.5 mm². The cable does not have to be shielded specially. The cable length between the bus controller and the power distribution board SVS201-PWR-xx must not exceed 2 m.

Use of the terminals for applications not provided for in the operation manual or improper connection can lead to malfunction or destruction of the device.

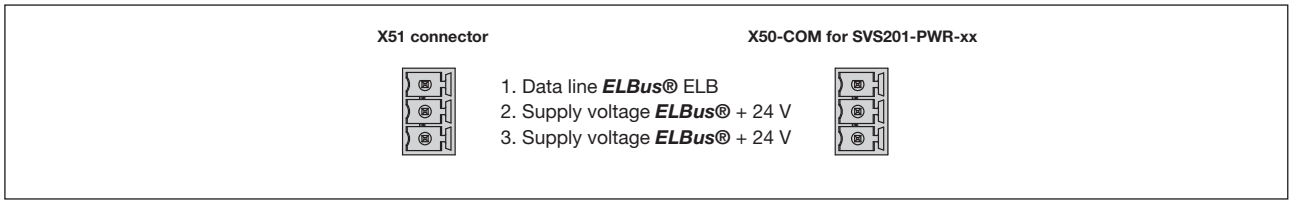


fig. 5: ***ELBus***® connection

If the terminals of the various power distribution boards SVS201-PWR-xx are swapped, e.g. exchange X51 with X52, the connected electronic circuit protectors will automatically be parameterised anew.

3.4.3 USB service interface, terminals X61

The USB interface serves for connection of the service computer. By means of the available user software ***ControlPlex®***Views it is possible to import the measuring values of the individual circuit protectors, to change parameters and to switch the devices on or off. The connection is realised by means of USB-2.0 type B. The length must be less than 3 m. In the event of a bus communication with the superordinate control unit, the user software has only reader access. If a change of the device parameters should be made possible on behalf of the user software, this has to be explicitly released by the superordinate control unit.

3.4.4 Bus interfaces to PROFINET, connector socket X81, X82

The PROFINET connection is implemented by means of push-pull RJ45 connectors. It allows direct connection of the device with other PROFINET participants. For mounting and special selection of cables and connectors please see mounting guideline of the PNO.

3.4.5 LED PWR

The PWR diode lights up green if voltage is applied.

3.4.6 LED CE

The LED CE shows the status of the communication unit. For more detailed information please see chapter »Signalling of various operating modes«.

3.4.7 LED CM

The LED CM shows the status of the communication between the communication unit and electronic circuit protector. For more detailed information please see chapter »Signalling of various operating modes«.

3.4.8 LED MS

The LED MS shows the status of the internal PROFINET communication module.

3.4.9 LED NS

The LED NS shows the network status of the communication of the internal PROFINET communication module to the PROFINET master.

3.4.10 LED X81 A and X82 A

The LED indicates the communication status.

3.4.11 LED X81 B and X82 B

The LED has no use whatsoever.

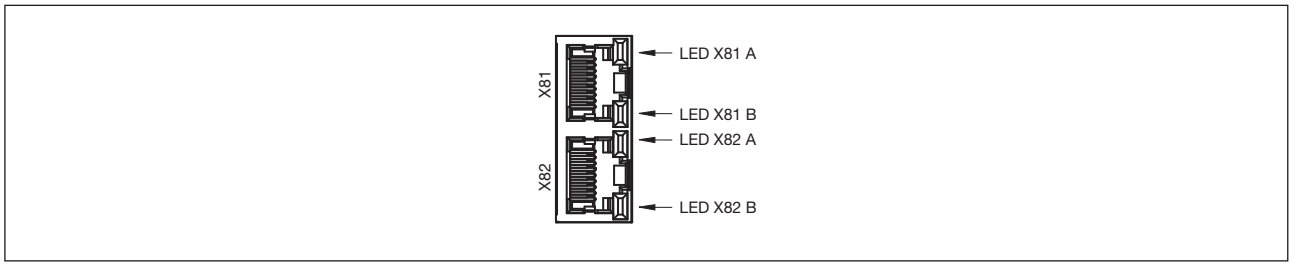


fig. 6: signalling RJ45 connectors

4 Mounting and installation

4.1 Mounting of the system

The preferred mounting position of the ***ControlPlex®*** system is horizontal.

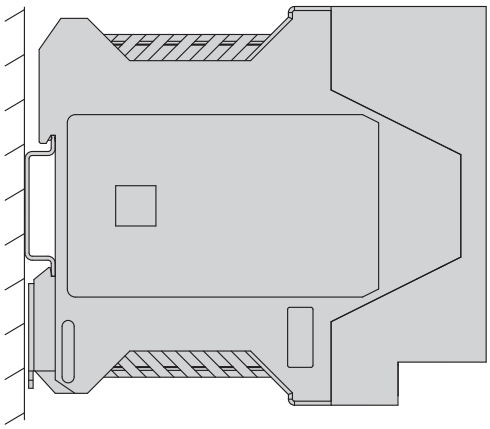
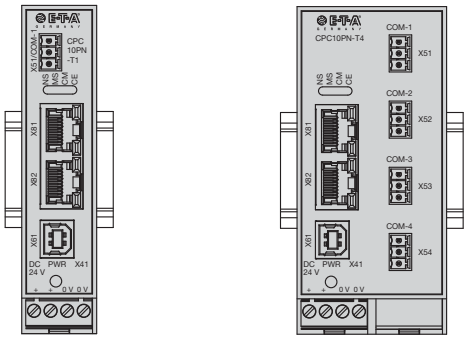


fig. 7: Installation drawing

4.2 Wiring and connecting the modules



Bus-Controller CPC10PN-T1 **Bus-Controller CPC10PN-T4**

fig. 8: Terminals CPC10PN-T1 and -T4

4.2.1 Supply of terminal strip X41

Rated voltage	DC 24 V (18 ... 32 V)
Current ratings	typically 60 mA
Terminals	4 x screw terminals, (+/+/0 V/0 V)
Max. cable cross section	max. 2.5 mm^2
Flexible with wire end ferrule without plastic sleeve	0.25 mm – 1.5 mm^2
Flexible with wire end ferrule without plastic sleeve	0.25 mm – 2.5 mm^2
Wire stripping length	7 mm
Tightening torque	0.5 to 0.6 Nm

4.2.2 *ELBus*® connector sockets to power distribution system (-X51, -X52, -X53, -X54)

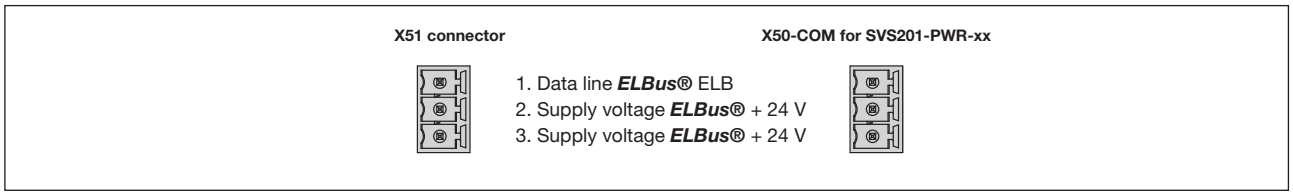


fig. 9: Terminals of the ***ELBus***® connectors

X51 COM-1:terminal for first power distribution board SVS201-PWR-xx

Cable length:	max. 2 m	
Typically:	H07V-K 1.5 mm²	
Connector 1:	***ELBus***® ELB	Data line
Connector 2:	***ELBus***®	DC + 24 V
Connector 3:	***ELBus***®	GND

X52 COM-2:terminal for second distribution board SVS201-PWR-xx

Cable length:	max. 2 m	
Typically:	H07V-K 1.5 mm²	
Connector 1:	***ELBus***® ELB	Data line
Connector 2:	***ELBus***®	DC + 24 V
Connector 3:	***ELBus***®	GND
(only with CPC10PN-T4)		

X53 COM-3:terminal for third distribution board SVS201-PWR-xx

Cable length:	max. 2 m	
Typically:	H07V-K 1.5 mm²	
Connector 1:	***ELBus***® ELB	Data line
Connector 2:	***ELBus***®	DC + 24 V
Connector 3:	***ELBus***®	GND
(only with CPC10PN-T4)		

X54 COM-4:terminal for fourth distribution board SVS201-PWR-xx

Cable length:	max. 2 m	
Typically:	H07V-K 1.5 mm²	
Connector 1:	***ELBus***® ELB	Data line
Connector 2:	***ELBus***®	DC +24 V
Connector 3:	***ELBus***®	GND
(only with CPC10PN-T4)		

4.2.3 USB service and maintenance interface (-X61)

X61	Connection to a PC for communication with the user software ***ControlPlex®***Views
Type:	USB-2.0 Type B
Cable length:	max. 2.0 m

4.2.4 PROFINET interface with integral switch (-X81, -X82)

X81	Connection to bus system PROFINET
Type:	connector RJ45
When wiring and connecting to the bus system PROFINET the installation and wiring regulationsof the PROFIBUS User Organisation (PNO) have to be observed.	

X82	Connection to bus system PROFINET
Type:	connector RJ45
When wiring and connecting to the bus system PROFINET the installation and wiring regulations of the PROFIBUS User Organisation (PNO) have to be observed.	

5 Operating modes of the CPC10PN controller

5.1 Operating mode: Start-up mode

The bus controller is initialised by applying the supply voltage. The device will carry out implemented programme memory tests and self test routines. During this time a communication via the interfaces is not possible.

5.2 Operating mode: System error mode

If a failure is detected during the self test routines, the bus controller will change into operating mode System Error. This operating mode can only be discontinued by way of re-starting the device and it prevents the data exchange via the interfaces. If the bus controller is in the aforementioned operating mode, it is unable to control the electronic circuit protectors and these will stay in the stand-alone mode (overcurrent protection).

5.3 Operating mode: Configuration error mode

If there are no valid or invalid configuration data available in the bus controller, it will change into the Configuration Error Mode. This operating mode only allows non-cyclical data exchange. Cyclical data exchange is prevented. Leave this operating mode upon receipt of the correct slot parameters and configuration data.

5.4 Operating mode: stand-alone mode

In normal duty there is a connection between the bus controller and the superordinate control unit. Thus the electronic circuit protectors are controlled and their parameterss are changed by the superordinate control unit. Should the communication between both participants fail, this has no influence on the protective function of the circuit protectors. In this case the bus controller CPC10 will automatically adopt the control and parameterisation of the electronic circuit protectors, because are required data sets are saved within the CPC10. By means of the user software ***ControlPlex®Views*** the electronic circuit protectors, their status and parameters can be accessed via the maintenance and service interface. It is thus possible to change e.g. parameter data of the various electronic circuit protectors. If the failure on the communication level is remedied, this operating mode will be left and the superordinate control unit will take over control again as master. If during this time a parameter was changed while there was no communication, this will be signalled to the superordinate control unit. In this case the user can correspondingly define the control behaviour and it can be programmed in the programmable control unit. This allows the user to select a reaction meeting his requirements.

5.5 Operating mode: Slave mode

In this operating mode the bus controller CPC10 is involved in a PROFINET system. Communication to the bus controller CPC10 works faultlessly and the controller can be addressed and controlled by the superordinate control unit.

The behaviour of the bus controller with simultaneous use of a field bus interface and the USB service and maintenance interface can be determined by means of the configuration of the device in the superordinate control unit. It can be pre-selected there that the USB service and maintenance interface is granted either only reader access or reader and editor access. In the event of editor access, changes of the parameterisation of the electronic circuit protectors can be carried out in parameter selection to the field bus system. These parameter changes will then be advised to the superordinate control system and can be adopted by it or also overwritten. The user can select the behaviour accordingly.

5.6 Operating mode: Firmware Update Mode

The devices are supplied with a software programmed according to their functionality. If the functions of the devices are extended, this will be carried out in the firmware. It is therefore necessary to carry out a firmware update if the new functionality shall be used. More detailed information regarding the firmware update is made available in the user manual of the software ***ControlPlex®***Views.

5.7 Signalling of the various operating modes

The different operating modes of the bus controller CPC10 are indicated as follows:

Operating mode	**Indication of operating mode**		
	LED CM	**LED CE**	**LED PWR**
Start-up mode	yellow	yellow	green
System error mode	yellow	red	green
Configuration error mode	yellow	red/OFF*	green
Stand-alone mode	yellow	-	green
Slave mode	green	OFF	green
Firmware update	red/OFF*	red/OFF*	red/OFF*

* blinking

fig. 10: List of the available operating modes

6 Basic functions of the entire system

6.1 Internal cycle times

The cycle time of the system depends on the number of data to be transmitted between the bus controller CPC10 as well as the number of slots intended on the power distribution system for the electronic circuit protectors ESX50D-S. The cycle time decreases when using a power distribution board with four slots as opposed to the cycle time with a power distribution system with 24 slots from 730 ms to 230 ms. During the aforementioned period the status, the output voltage and the load current of each circuit protector is cyclically transmitted to the CPC10. This has to be seen independently of the number of connected power distribution boards SVS201-PWR with which the CPC10 communicates in parallel. The cycle time of the entire system goes by the longest cycle time of the designed power distribution board. If for instance a power distribution board with 16 and three more with 8 slots are connected to a CPC10PN-T4, the cycle time will comply with the 16-slot-board and will thus be 530 ms for all four connected power distribution systems.

It is possible to choose the data quantity for the communication to the superordinate control unit. This can be achieved by using the different data models. It is therefore possible to transmit either the status, the measuring values for the load current and the output voltage of the electronic circuit protector or to only send the circuit protector status to the superordinate control unit. The choice between the various data models is made available to the user in the GSDML file of the control system. These are configuration data which are transmitted to the store programme control by means of the hardware configuration of the CPC10.

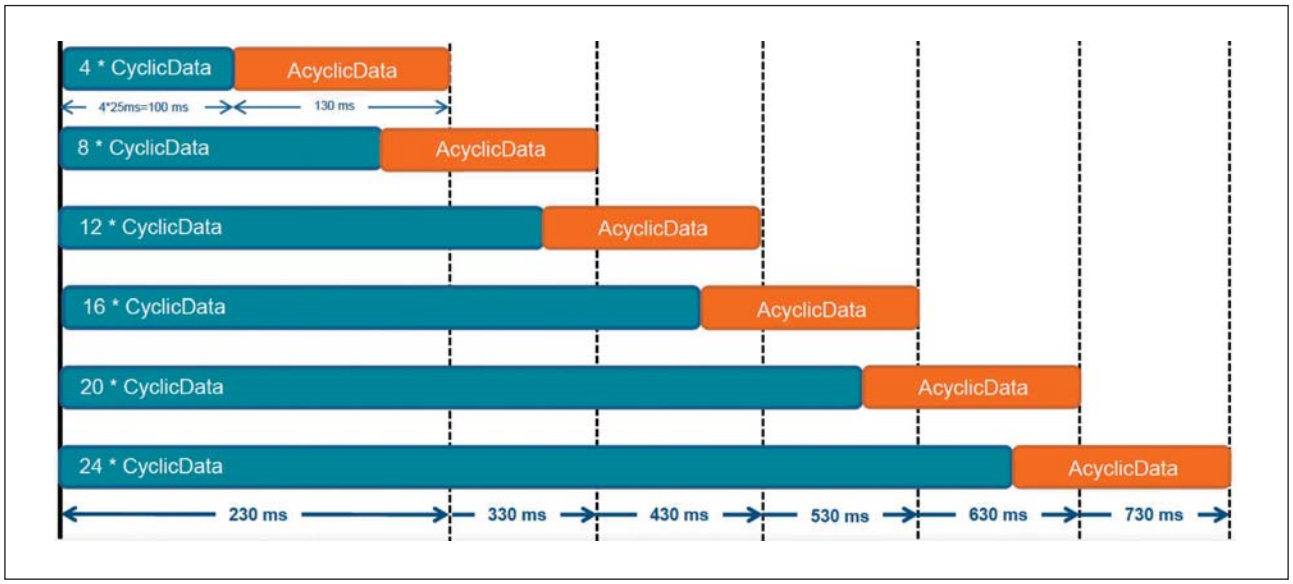


fig. 11: Cycle times of the system

6.2 Hot swap of circuit protectors

The electronic circuit protectors ESX50D-S can be plugged into the power distribution board SVS201-PWR-xx at any time. The ON/OFF button of the electronic circuit protector has to be in the OFF position.

For safety reasons the electronic circuit protectors ESX50D-S must only be plugged in in the OFF condition.

After plugging in a circuit protector, it will automatically be parameterised if parameters are available for the slot in question. Transmission of the parameters will be without interruption of the cyclical data exchange between the communication unit SVS200-COM and the electronic circuit protector ESX50D-Sxx. After switching the device on with the ON/OFF button, the electronic circuit protector is ready for use.

6.3 Communication via the USB service interface

In addition to the PROFINET interface, a maintenance and service interface will also be made available to the user. It enables direct access to the bus controller CPC10PN. This is also possible when there is no communication via the field bus interface. If the device is in the stand-alone mode, the user can access the bus controller and the connected electronic circuit protectors at any time (reading or editing) via this interface. The access in the slave mode can be parameterised by the user via the field bus interface. The delivery condition allows only reading access. Editor access has to explicitly be released by the user in the superordinate control unit.

If the slot parameters are changed, the change will be signalled to the superordinate control unit. The user will thus be able to process these changes in his control accordingly.

For parameterisation of the individual electronic circuit protectors the corresponding user software ***ControlPlex®***Views is available for the USB service interface. This software is available for download from the E-T-A website and can be installed on a Windows® computer. The user software is described separately in another manual.

7 Communication via 7 PROFINET

7.1 *ControlPlex®* device model

The CPC10PN controller has terminals for up to four SVS201-PWR-xx boards. The SVS201-PWR-xx boards are purely passive. There are versions with 4, 8, 12, 16, 20 and 24 slots for the circuit protectors.

The power distribution system ***ControlPlex®*** uses the following PROFINET model:

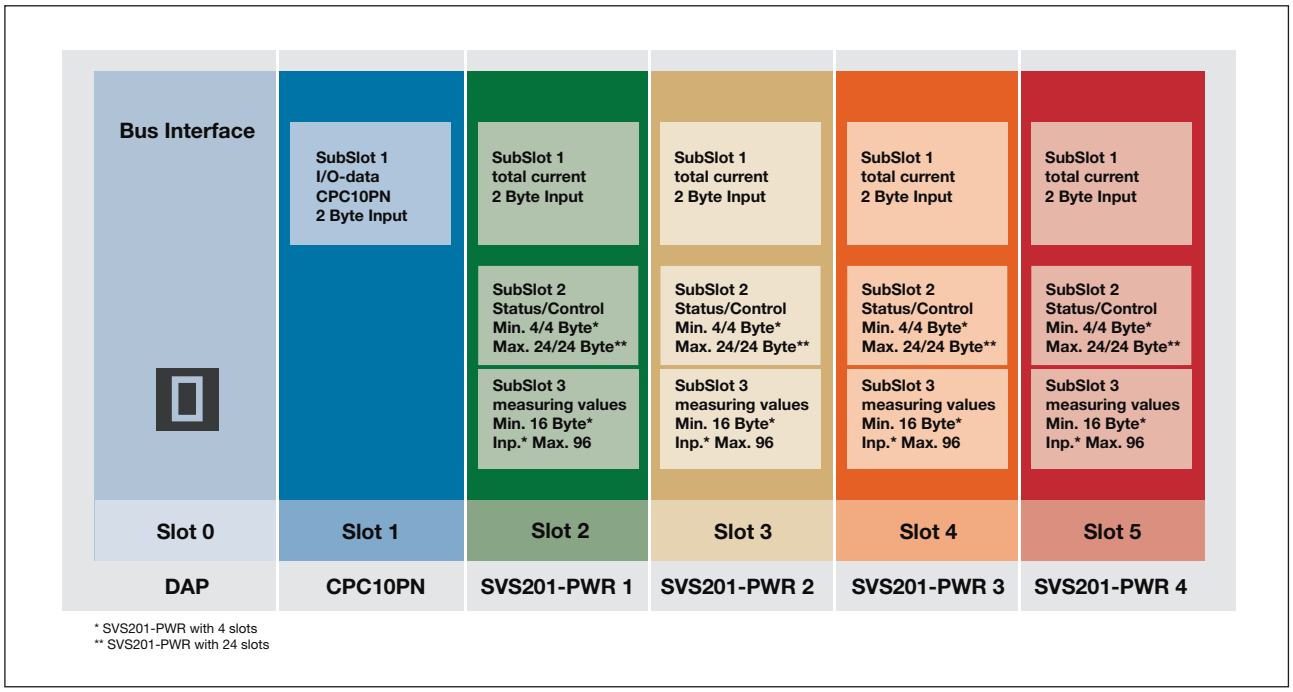


fig. 12: Device model

PROFINET	CPC10PN
Device	The CPC10PN controller itself. It has the following features: ● The PROFINET interface (DAP) via which the master communicates with the CPC10PN controller. ● Up to 4 terminals for connecting the SVS201-PWR boards. These 4 terminals are made available as »slots« in the GSDML file.
Slot	A slot corresponds to the terminal for one SVS201-PWR board. In addition there is a slot for the I/O data of the CPC10PN controller. This slot (slot 1) is firmly installed and cannot be removed. A sub-module with firm I/O assignment has already been »plugged« in this slot. This sub-module contains 2 input and output bytes which are described in more detail in the chapter Module I/O Data CPC10PN controller. The GSDML file provides modules for »insertion« into the 4 available slots of the CPC10PN in accordance with the different SVS201-PWR boards (example: 16-way module for SVS201-PWR-16, for accommodation of up to 16 circuit protectors). The slots 2-5 correspond to the terminals of the SVS201-PWR board and hold three sub-module slots which can be occupied dynamically by the PLC configuration. ⚠ The module type is not directly checked, i.e. if a 4-way module is »plugged in« during the project planning stage, but eventuelly a SVS201-PWR-8 is connected, this configuration will boot correctly. However, in this case only the first 4 circuit protectors will be included in the cyclical data exchange, the remaining 4 will not be contained in the process data image. The reverse case is equally allowed (8-way module planned, but only an SVS201-PWR-4 connected. In this case the lacking circuit protectors will be signalled as »not available« in the cyclical process data image).
sub-slot	Each module has three sub-slots: **slot 1:** total current of the SVS201-PWR board **slot 2:** status and control bytes of the circuit protectors **slot 3:** measuring values of the circuit protectors A corresponding sub-module (from the GSDML file) can be »plugged« into each slot or the slot can remain empty. If the slot remains empty, no cyclical process data will be exchanged for the slot. The quantity of the process data to be exchanged cyclically can be determined via this mechanism (on the level of the SVS201-PWR board) depending on the application.
Channel	The channel is not used.

fig. 13: communication properties

7.2 GSDML file

The GSDML file is in the download area of the E-T-A website and can be downloaded there.

7.3 I&M - data (identification & maintainance)

The following I&M data are made available by the CPC10PN controller:

I&M data	length:	data set	meaning	SVS200
MANUFACTURER_ID	2 bytes	I&M0*	manufacturer identification	
ORDER_ID	20 bytes	I&M0*	part number	
SERIAL_NUMBER	16 bytes	I&M0*	serial number	
HARDWARE_REVISION	2 bytes	I&M0*	revision index	
SOFTWARE_REVISION	4 bytes	I&M0*	firmware version	
REVISION_COUNTER	2 bytes	I&M0*		
PROFILE_ID	2 bytes	I&M0*	profile ID	F600h (generic device)
PROFILE_TYP	2 bytes	I&M0*	profile-specific coding	0004h (no profile)
IM_VERSION	2 bytes	I&M0*	version of the I&M data	0100h (version 1.0)
IM_SUPPORTED	2 bytes	I&M0*	supported data sets	0000h (IM0)
TAG_FUNCTION	32 bytes	I&M1	unique marking throughout the system	
TAG_LOCATION	22 bytes	I&M1	installation area	
Installation_DATE	16 bytes	I&M2	installation date and time	
DESCRIPTOR	54 bytes	I&M3	comments	
SIGNATURE	54 bytes	I&M4	Security Code	

fig. 14: I&M data

8 Cyclical I/O data

Depending on the planned module type and the selected sub-modules, a varying number of data bytes are exchanged in the cyclical data traffic.

The system allows individual determination per PWR board if I/O data (status/control), measuring values and/or total current shall be transmitted. The GSDML file made available for the projecting tool allows the related configuration, the system recognises all permitted configurations and processes the cyclical data defined in the projection.

Only the module I/O data CPC10PN controller is firmly pre-set and cannot be removed because the input bytes hold vital failure and diagnostic information as described in the following.

8.1 Module I/O data CPC10PN controller

The 2 bytes input data contain the following global error and diagnostic messages. This module does not contain any output data.

Value range: 0 – 65535

Data length: 2 byte (unsigned integer)

Byte[0] low	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
no configuration data available								0/1*
invalid configuration data							0/1*	
reserve								
reserve								
command buffer overflow				0/1*				
reserve								
reserve								
no communication with at least one PWR board	0/1*							
Byte[1] High	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
reserve								
CPC10PN temporary error							0/1*	
CPC10PN hardware error						0/1*		
reserve								
reserve								
reserve								
network error		0/1*						
writing via USB blocked	0/1*							

* error/diagnosis not available = 0 / error/diagnosis available = 1

fig. 15: Diagnostic data

8.2 Submodule Status/Control

Depending on the configuration (corresponding to the number of slots of the projected power module) one byte input data with the status of the circuit protector and one byte output data for controlling the circuit protectors are exchanged. In the event of a power module with 16 slots, 16 bytes input data and 16 bytes output data are exchanged.

Addressing will follow the slot sequence, slot 1 byte address [0]

8.2.1 Status circuit protector

Design of the input byte per circuit protector slot is as follows (status circuit protector):

Value range: 0 – 255

Data length: 1 byte (unsigned character)

Byte[0]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
status load output								0/1*
status short circuit							0/1*	
status overload						0/1*		
status undervoltage					0/1*			
status overvoltage				0/1*				
status excess temperature			0/1*					
status limit value current		0/1*						
status event	0/1*							

* status not set = 0 / status set = 1

fig. 16: Status circuit protector

8.2.2 Control circuit protector

Design of the output byte per circuit protector slot is as follows (control circuit protector):

Value range: switch load output on/off, reset load output, output data valid/invalid

Data length: 1 byte (unsigned character)

Byte[0]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
load output ON/OFF								0/1*
reset load output							1**	
reserve								
reserve								
reserve								
reserve								
reserve								
output data valid/invalid	0/1**							

* switch on load output = 1 / switch off load output = 0

** reaction only to rising flank (bit 1 requires value ZERO in the previous cycle)

*** output data valid = 1 / output data invalid = 0

fig. 17: Control circuit protector

8.3 Submodule measuring values

Depending on the module type (corresponding to the number of slots of the projected power module) four bytes input data with the measuring values of load current and load voltage of the corresponding circuit protector are made available. For a power module with 16 slots, 16 * 4 = 64 bytes input data are transmitted. Addressing will follow the slot sequence, slot 1 byte address [0] The sub-module does not have output data.

The sequence of the measuring values is load current (2 bytes), followed by load voltage (2 bytes)

8.3. Load current circuit protector

Design of the input bytes per circuit protector slot is as follows (measuring value load current):

Value range: 0 – 65535

Data length: 2 byte (unsigned integer)

Byte[0] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[1] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 18: Circuit protector load current

The load current is made available as a standardised 16-bit-value with a solution of 10 mA.

Example: measuring value load current = 1025 → real measuring value = 10.25 Ampere.

8.3. Load voltage circuit protector

Design of the input bytes per circuit protector slot is as follows (measuring value load voltage):

Value range: 0 – 65535

Data length: 2 byte (unsigned integer)

Byte[2] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[3] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 19: Circuit protector load voltage

The load voltage is made available as a standardised 16-bit-value with a solution of 10 mV.

Example: measuring value load voltage = 2456 → real measuring value = 24.56 Volt.

8.4 Submodule total current

The sub-module total current supplies a standardised 16 Bit value with the calculated total current of an SVS201-PWR module (2 byte input data). The sub-module does not have output data.

The measuring value is indicated as follows:

Value range: 0 – 65535

Data length: 2 byte (unsigned integer)

Byte[0] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[1] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 20: Total current

The total current is made available as a standardised 16-bit-value with a solution of 10 mA.

Example: measuring value load current = 3522 → real measuring value = 35.22 Ampere.

9 Non-cyclical data

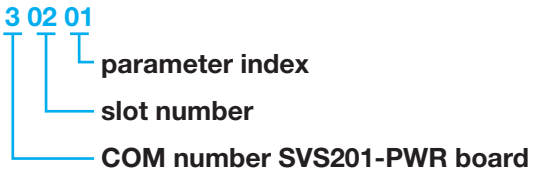
Non-cyclical PROFINET services allow exchange of more data with the CPC10PN controller and the circuit protectors.

The access also enables direct addressing of a circuit protector on an SVS201-PWR board. Here only the PROFINET index is used, slot number and sub-slot number are irrelevant.

The index is set up as follows:

physics	index digit	description
COM number SVS201-PWR board	decimal numbers 10^4	number of the SVS201-PWR board corresponding to the COM number Valid value range: 0…4
slot number	decimal numbers 10^3 and 10^2	slot of circuit protector on the SVS201-PWR board. Valid value range: 00…24
parameter index	decimal numbers 10^1 and 10^0	the parameter index defines the data range and the data type of the data to be read or written, valid value range: 01…10

fig. 21: Index structure



The index is assigned to the following non-cyclical data areas:

parameter index	PWR-Board COM no.	slot number	number of data bytes	reading (R) writing (W)	description
01	1…4	01…24	8	R/W	parameters of a circuit protector (see chapter 11.5)
02	0	00	9	R	device information on the CPC10PN controller (see chapter 11.3)
02	1…4	01…24	9	R	device information of a circuit protector (see chapter 11.4)
03	0	00	6	R/W	configuration data of the CPC10PN controller (see chapter 11.1)
03	1…4	01…24	6	R/W	configuration data of a slot for the circuit protector (see chapter 11.2)
04	1…4	01…24	1	R	event of a circuit protector (see chapter 11.7)
05	1…4	01…24	1	W	action commands for a circuit protector (see chapter 11.6)
05	1…4	99	1	W	action commands for all circuit protectors on a PWR board (see chapter 11.6)

parameter index	PWR-Board COM no.	slot number	number of data bytes	reading (R) writing (W)	description
06	1…4	01…24	9	R	diagnostic data of a circuit protector (see chapter 11.8)
07	1…4	01…24	200	R	bar chart (measuring values 0...199) of a circuit protector (see chapter 11.9)
08	1…4	01…24	200	R	bar chart (measuring values 200...399) of a circuit protector (see chapter 11.9)
09	1…4	01…24	200	R	bar chart (measuring values 400...599) of a circuit protector (see chapter 11.9)
10	1…4	01…24	200	R	bar chart (measuring values 600...799) of a circuit protector (see chapter 11.9)

fig. 22: Set-up parameter index

9.1 Configuration data CPC10PN controller

These bytes hold the configuration data for the CPC10PN controller.

6 bytes are exchanged non-cyclically as configuration data for the CPC10PN controller. Currently only the first byte holds configuration options. The other bytes presently serve as placeholders for possible later extensions and are not evaluated.

Byte[0] holds configuration options of the service interface (USB) as well as about the behaviour of the circuit protectors when the connection to the master control is interrupted.

Value range: 0 – 255

Default value: 03

Data length: 1 byte (unsigned character)

Byte[0]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
write instructions via USB (service interface)								0/1*
offline behaviour (low/freeze)							0/1**	
power saving mode						0/1**		
reserve								
reserve								
reserve								
reserve								
reserve								

* writing via USB blocked = 0 / writing via USB released = 1

** Low = 0 (all load outputs of the circuit protectors are switched off and the CPC10PB controller changes into the the operating mode stand-alone).

** Freeze = 1 (all load outputs of the circuit protectors keep their current state and the CPC10PB controller changes into the the operating mode stand-alone).

*** power saving mode deactivated = 0 / power saving mode activated = 1

fig. 23: Configuration data CPC10PN

Byte[1] – Byte[5] do not contain information.

Value range: -

Default value: -

Data length: 5 byte (unsigned character)

Byte[1] – Byte[5]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
reserve	-	-	-	-	-	-	-	-

fig. 24: Configuration data reserve bytes

9.2 Configuration data slot for circuit protector

These bytes hold configuration data for the slots of the circuit protectors.

6 bytes are exchanged non-cyclically as configuration data for the slots. The first byte holds the device type which shall be plugged into the corresponding slot. The second byte holds information about whether the slot is released or locked out. Communication is not possible with a locked-out slot, and hence no operation of a circuit protector either.

The other bytes presently serve as placeholders for possible later extensions and are not evaluated.

Byte[0] holds the type version of the circuit protector.

Value range: 80-81

Default value: 80

Data length: 1 byte (unsigned character)

Byte[0]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
ESX50D-S100 (80)	0	1	0	1	0	0	0	0
ESX50D-S110 (81)	0	1	0	1	0	0	0	1

fig. 25: Configuration data device type

Byte[1] holds the release information about the slot for the circuit protector.

Value range: 0 – 255

Default value: 01

Data length: 1 byte (unsigned character)

Byte[1]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
release of slot								0/1*
reserve								
reserve								
reserve								
reserve								
reserve								
reserve								
reserve								

* slot blocked = 0 / slot released = 1

fig. 26: Configuration data release of slot

Byte[2] – Byte[5] do not contain information.

Value range: -

Default value: -

Data length: 4 byte (unsigned character)

Byte[2] – Byte[5]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
reserve	-	-	-	-	-	-	-	-

fig. 27: Configuration data reserve bytes

9.3 Device information CPC10PN controller

9.3.1 Device type

Byte[0] holds information on the device type of the CPC10PN controller.

Value range: 80-81

Error: Device type not available (255)

Data length: 1 byte (unsigned character)

Byte[0]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
CPC10PN-T1 (80)	0	1	0	1	0	0	0	0
CPC10PN-T4 (81)	0	1	0	1	0	0	0	1

fig. 28: Device information CPC10 - device type

9.3.2 Serial number

Byte[1] - Byte[4] contain the serial number of the CPC10PN controller.

Value range: 0…4294967295

Error: Serial number not available (4294967295)

Data length: 4 byte (unsigned long)

Byte[1] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[2]	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[3]	**Bit 23**	**Bit 22**	**Bit 21**	**Bit 20**	**Bit 19**	**Bit 18**	**Bit 17**	**Bit 16**
description	8388608	4194304	2097152	1048576	524288	262144	131072	65536
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[4] (HIGH)	**Bit 31**	**Bit 30**	**Bit 29**	**Bit 28**	**Bit 27**	**Bit 26**	**Bit 25**	**Bit 24**
description	2147483648	1073741824	536870912	268435456	134217728	67108864	33554432	16777216
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 29: Device information CPC10 - serial number

9.3.3 Hardware version

Byte[5] - Byte[6] contain the hardware version of the CPC10PN controller. The hardware version is made available in whole numbers.

Value range: 0…65535

Error: Hardware version not available (65535)

Data length: 2 byte (unsigned integer)

Byte[5] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[6] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 30: Device information CPC10 - hardware version

9.3.4 Software version

Byte[7] - Byte[8] contain the software version of the CPC10PN controller. The software version is made available BCD coded. It is coded as follows:

software version = X.Y.Z

High Byte (Bit 12 – Bit 15) = 0

High Byte (Bit 8 – Bit 11) = X

Low Byte (Bit 4 – Bit 7) = Y

Low Byte (Bit 0 – Bit 3) = Z

Value range: 0…65535

Error: Software version not available (65535)

Data length: 2 byte (unsigned integer)

Byte[7] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[8] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0	0	0	0/1	0/1	0/1	0/1

fig. 31: Device information CPC10 - software version

9.4 Device information circuit protector

9.4.1 Device type

Byte[0] holds information on the device type of the circuit protector.

Value range: 80-81

Error: Device type not available (255)

Data length: 1 byte (unsigned character)

Byte[0]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
ESX50D-S100 (80)	0	1	0	1	0	0	0	0
ESX50D-S110 (81)	0	1	0	1	0	0	0	1

fig. 32: Device information circuit protector - device type

9.4.2 Serial number

Byte[1] - Byte[4] contain the serial number of the circuit protector

Value range: 0…4294967295

Error: Serial number not available (4294967295)

Data length: 4 byte (unsigned long)

Byte[1] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[2]	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[3]	**Bit 23**	**Bit 22**	**Bit 21**	**Bit 20**	**Bit 19**	**Bit 18**	**Bit 17**	**Bit 16**
description	8388608	4194304	2097152	1048576	524288	262144	131072	65536
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[4] (HIGH)	**Bit 31**	**Bit 30**	**Bit 29**	**Bit 28**	**Bit 27**	**Bit 26**	**Bit 25**	**Bit 24**
description	2147483648	1073741824	536870912	268435456	134217728	67108864	33554432	16777216
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 33: Device information circuit protector - serial number

9.4.3 Hardware version

Byte[5] - Byte[6] contain the hardware version of the circuit protector The hardware version is made available in whole numbers.

Value range: 0…65535

Error: Hardware version not available (65535)

Data length: 2 byte (unsigned integer)

Byte[5] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[6] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 34: Device information circuit protector - hardware version

9.4.4 Software version

Byte[7] - Byte[8] contain the software version of the circuit protector The software version is made available BCD coded. It is coded as follows:

software version = X.Y.Z

High Byte (Bit 12 – Bit 15) = 0

High Byte (Bit 8 – Bit 11) = X

Low Byte (Bit 4 – Bit 7) = Y

Low Byte (Bit 0 – Bit 3) = Z

Value range: 0…65535

Error: Software version not available (65535)

Data length: 2 byte (unsigned integer)

Byte[7] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[8] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0	0	0	0/1	0/1	0/1	0/1

fig. 35: Device information circuit protector - software version

9.5 Device parameters circuit protector

9.5.1 Current rating

The parameter in byte[0] determines the current rating of the ESX50D-S100.

Value range: 1A – 10 A (whole numbers)

Default value: 1 A (only with type ESX50D-S100)

Data length: 1 byte (unsigned character)

Regarding this parameter two types of device have to be distinguished. This parameter is only readable or writable with type ESX50D-S100. With type ESX50D-S110 this parameter is only readable.

Byte[0]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	1	0	1	0	0/1	0/1	0/1	0/1
1 Ampere (161)	1	0	1	0	0	0	0	1
2 Ampere (162)	1	0	1	0	0	0	1	0
3 Ampere (163)	1	0	1	0	0	0	1	1
4 Ampere (164)	1	0	1	0	0	1	0	0
5 Ampere (165)	1	0	1	0	0	1	0	1
6 Ampere (166)	1	0	1	0	0	1	1	0
7 Ampere (167)	1	0	1	0	0	1	1	1
8 Ampere (168)	1	0	1	0	1	0	0	0
9 Ampere (169)	1	0	1	0	1	0	0	1
10 Ampere (170)	1	0	1	0	1	0	1	0

fig. 36: Device parameters of circuit protector - rating

9.5.2 Switch-on behaviour

This parameter in byte[1] determines the behaviour of the load output of the ESX50D after connection of the supply voltage.

Value range: 161-163

Default value: 161 (condition before power off)

Data length: 1 byte (unsigned character)

Byte[1]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
condition before power off (161)	1	0	1	0	0	0	0	1
Off (162)	1	0	1	0	0	0	1	0
On (163)	1	0	1	0	0	0	1	1

fig. 37: Device parameter circuit protector - switch-on behaviour

9.5.3 Overload disconnection

The parameter in byte[2] determines at how many percent of the rated current the ESX50D will signal overload.

Value range: 105 % - 135 % (whole numbers)

Default value: 120 %

Data length: 1 byte (unsigned character)

Byte[2]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 112 %	0	1	1	1	0	0	0	0

fig. 38: Device parameter circuit protector - overload disconnection

9.5.4 Trip time at overload

The parameter in byte[3] determines after which perod in the overload range the load output of the ESX50D will be disconnected.

Value range: 50 ms – 10,000 ms (whole numbers in 50 ms steps)

Default value: 3000 ms

Data length: 1 byte (unsigned character)

Byte[3]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 3000 ms 50 ms * value (multiplier) = 50 ms * 60 = 3000 ms	0	0	1	1	1	1	0	0

fig. 39: Device parameter circuit protector - disconnection time overload

9.5.5 Trip time at short circuit

The parameter in byte[4] determines after which perod in the short circuit range the load output of the ESX50D will be disconnected.

Value range: 50 ms – 1,000 ms (whole numbers in 10 ms steps)

Default value: 100 ms

Data length: 1 byte (unsigned character)

Byte[4]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 100 ms 10 ms * value (multiplier) = 10 ms * 10 = 100 ms	0	0	0	0	1	0	1	0

fig. 40: Device parameter circuit protector - disconnection time short circuit

9.5.6 ON delay

The parameter in byte[5] determines the time delay between ON command the switch-on of the load output of ESX50D

Value range: 50 ms – 2,500 ms (whole numbers in 10 ms steps)

Default value: 100 ms

Data length: 1 byte (unsigned character)

Byte[5]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 50 ms 10 ms * value (multiplier) = 10 ms * 5 = 50 ms	0	0	0	0	0	1	0	1

fig. 41: Device parameter circuit protector - ON delay

9.5.7 Limit value load current

The parameter in byte[6] determines at how many percent of the rated current the ESX50D will signal "limit value exceeded".

Value range: 50 % - 100 % (whole numbers)

Default value: 80 %

Data length: 1 byte (unsigned character)

Byte[6]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 100 %	0	1	1	0	0	1	0	0

fig. 42: Device parameter circuit protector - limit value load current

9.5.8 Hysteresis of the limit value

This parameter (byte[7]) determines the hysteresis of the limit value current.

Value range: 5 % - 20 % (whole numbers)

Default value: 5 %

Data length: 1 byte (unsigned character)

Byte[7]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Example: 10 %	0	0	0	0	1	0	1	0

fig. 43: Device parameter circuit protector - hysteresis limit value

9.6 Action commands circuit protector

This output byte allows non-cyclical execution of all actions supported by the circuit protector. All actions are also possible as "broadcast command". This will address all circuit protectors on a PWR board simultaneously. The index part addressing the slot of the circuit protector has to be set to 99 in this case.

Value range: 112 -118 126-127

Data length: 1 byte (unsigned character)

Byte[0]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
switch on load output (112)	0	1	1	1	0	0	0	0
switch off load output (113)	0	1	1	1	0	0	0	1
reset load output (114)	0	1	1	1	0	0	1	0
reset error memory (115)	0	1	1	1	0	0	1	1
reset trip counter (116)	0	1	1	1	0	1	0	0
delete bar chart (117)	0	1	1	1	0	1	0	1
reset device parameters to factory settings (118)	0	1	1	1	0	1	1	0
deactivate LED indication (126)	0	1	1	1	1	1	1	0
deactivate LED indication (127)	0	1	1	1	1	1	1	1

fig. 44: Action commands circuit protector

9.7 Event messages circuit protector

This byte contains information on events of the circuit protector.

Value range: 0 – 255

Data length: 1 byte (unsigned character)

Byte[0]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
waiting for parameterisation								0/1*
bar chart available							0/1*	
new current rating available						0/1*		
slide switch = OFF					0/1*			
reserve								
reserve								
reserve								
error detected	0/1*							

* event not available = 0 / event available = 1

fig. 45: Event messages circuit protector

9.8 Diagnostic messages circuit protector

9.8.1 Error memory

Byte[0] holds the internal error memory of the circuit protector.

Value range: 0 – 255

Data length: 1 byte (unsigned character)

Byte[0]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
no parameters available								0/1*
error parameter memory							0/1*	
error programme memory						0/1*		
error data memory					0/1*			
error control unit				0/1*				
reset through watchdog			0/1*					
reserve								
reserve								

* error not available = 0 / error available = 1

fig. 46: Diagnosis circuit protector - error memory

9.8.2 Trip counter

Byte[1] - byte[2] contain the trip counter of the circuit protector

Value range: 0…65535

Data length: 2 byte (unsigned integer)

Byte[1] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[2] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 47: Diagnosis circuit protector - trip counter

9.8.3 Reason for trip

Byte[3] holds the latest reason for trip of the circuit protector.

Value range: 0 – 4

Data length: 1 byte (unsigned character)

Byte[3]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
no reason for trip available (0)	0	0	0	0	0	0	0	0
trip reason short circuit (1)	0	0	0	0	0	0	0	1
trip reason overload (2)	0	0	0	0	0	0	1	0
Auslösegrund device temperature (3)	0	0	0	0	0	0	1	1
reason for trip internal failure (4)	0	0	0	0	0	1	0	0

fig. 48: Diagnosis circuit protector - trip reason

9.8.4 Operating voltage

Byte[4] - byte[5] contain the operating voltage of the circuit protector

Value range: 0 – 65535

Data length: 2 byte (unsigned integer)

Byte[4] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[5] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 49: Diagnosis circuit protector - operating voltage

The operating voltage is made available as a standardised 16-bit-value with a solution of 10 mV.
Example: Measuring value operating voltage = 2512 → real measuring value = 25.12 V

9.8.5 Temperature

Byte[6] - byte[7] contain the internal device temperature of the circuit protector.

Value range: 0 – 65535

Data length: 2 bytes (integer)

Byte[6] (LOW)	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Byte[7] (HIGH)	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
description	32768	16384	8192	4096	2048	1024	512	256
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

fig. 50: Diagnosis circuit protector - device temperature

The internal device temperature is made available as a standardised 16-bit-value (integer) with a whole-number solution in degree centigrade.
Examples: Measuring value device temperature = 45 → real measuring value = 25°C.

9.8.6 Internal communication messages

Internally the CPC10PB controller communicates with each circuit protector by means of a specifically defined protocol. Byte[8] contains the relates latest feedback of the circuit protector to the CPC10PB controller.

Value range: 0 – 255

Data length: 1 byte (unsigned character)

Byte[8]	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
description	128	64	32	16	8	4	2	1
value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Presently used type does not match the configured type (1)	0	0	0	0	0	0	0	1
Device parameters not plausible (144)	1	0	0	1	0	0	0	0
No bar chart available (145)	1	0	0	1	0	0	0	1
Slide switch is in OFF position (146)	1	0	0	1	0	0	1	0
Undervoltage detected (147)	1	0	0	1	0	0	1	1
Overtemperature detected (148)	1	0	0	1	0	1	0	0
Reset command required (149)	1	0	0	1	0	1	0	1
Command was processed correctly (150)	1	0	0	1	0	1	1	0
Parameterisation required (151)	1	0	0	1	0	1	1	1
Internal failure detected (152)	1	0	0	1	1	0	0	0
Unknown command (153)	1	0	0	1	1	0	0	1
Set length error (154) **Rated current available**	1	0	0	1	1	0	1	0
Check sum error (155)	1	0	0	1	1	0	1	1
Rating selector switch was actuated (156)*	1	0	0	1	1	1	0	0

* only with type ESX50D-S100

fig. 51: Diagnosis circuit protector - internal communication

9.9 Bar chart circuit protector

The bar chart of a circuit protector contains 400 data sets with the measuring values of load voltage (U_{load}) and load current (I_{load}). The measuring values are saved as 8 bit values, i.e. a total of 800 data bytes.

The measuring values are permanently saved in the circuit protector with a frequency of 100 Hz. Recording is stopped with disconnection of the load through short circuit, overload or excess temperature (trip). The bar chart will then contain the measuring values of the last 4 seconds.

If for example the trip time at overload is parameterised to be 3 seconds, the measuring values will be saved 1 second before and 3 seconds after overload detection of the circuit protector.

As the data quantity is too big for a non-cyclical query, the entire bar chart has to be read with the following four indices:

parameter Index	PWR-Board COM no.	slot number	description
07	1…4	01…24	bar chart page 1 (measuring values 0...199) of a circuit protector.
08	1…4	01…24	bar chart page 2 (measuring values 200...399) of a circuit protector.
09	1…4	01…24	bar chart page 3 (measuring values 400...599) of a circuit protector.
10	1…4	01…24	bar chart page 4 (measuring values 600...799) of a circuit protector.

fig. 52: Structure index bar chart circuit protector

The measuring values are not stored as standardised values in the memory:

offset (byte)	data value	comments
[0]	$U_{load\ (tn)}$	first measuring value load voltage
[1]	$I_{load\ (tn)}$	first measuring value load current
[2]	$U_{load\ (tn+1)}$	second measuring value load voltage
[3]	$I_{load\ (tn+1)}$	second measuring value load current
…	…	…
[798]	$U_{load\ (tn+399)}$	latest measuring value load voltage
[799]	$I_{load\ (tn+399)}$	latest measuring value load current

fig. 53: Storage range of the bar chart data

The load voltage at the point of time (tn+x) is calculated with the following formula:

load voltage [V] = 8bit-decimal-value * 0.168

The load current at the point of time (tn+x) is calculated with the following formula:

load current [A] = (128 – 8-bit-decimal-value) * 0.143

10 Appendix

10.1 List of pictures

fig. 1: System overview 6
fig. 2: CPC10PN-T1 (1-Port) 7
fig. 3: CPC10PN-T4 (4-Port) 7
fig. 4: Status indication and terminals CPC10PN-Tx 8
fig. 5: ***ELBus***® connection 8
fig. 6: Signalling RJ45 connectors 9
fig. 7: Installation drawing 10
fig. 8: Terminals CPC10PN-T1 and -T4 10
fig. 9: Terminals of the ***ELBus***® connectors 11
fig. 10: List of the available operating modes 13
fig. 11: Cycle times of the system 14
fig. 12: Model 15
fig. 13: Communication features 16
fig. 14: I&M data 17
fig. 15: Diagnostic data 18
fig. 16: Status of circuit protector 19
fig. 17: Control circuit protector 20
fig. 18: Circuit protector load current 20
fig. 19: Circuit protector load voltage 21
fig. 20: Total current 21
fig. 21: Index structure 22
fig. 22: Structure of parameter index 22/23
fig. 23: Configuration data CPC10PN 23
fig. 24: Configuration data reserve bytes 24
fig. 25: Configuration data device type 24
fig. 26: Configuration data release of slot 25
fig. 27: Configuration data reserve bytes 25
fig. 28: Device information CPC10 - device type 25
fig. 29: Device information CPC10 - serial number 26
fig. 30: Device information CPC10 - hardware version 26
fig. 31: Device information CPC10 - software version 27
fig. 32: Device information circuit protector - device type 27
fig. 33: Device information circuit protector - serial number 28
fig. 34: Device information circuit protector - hardware version 28
fig. 35: Device information circuit protector - software version 29
fig. 36: Device parameters circuit protector - current rating 29
fig. 37: Device parameters circuit protector - switch-on behaviour 30

fig. 38: Device parameters circuit protector - overload disconnection 30
fig. 39: Device parameter circuit protector - disconnection time overload 30
fig. 40: Device parameter circuit protector - disconnection time short circuit 31
fig. 41: Device parameter circuit protector - ON delay 31
fig. 42: Device parameter circuit protector - limit value load current 31
fig. 43: Device parameter circuit protector - hysteresis limit value 32
fig. 44: Action commands circuit protector 32
fig. 45: Result messages circuit protector 33
fig. 46: Diagnosis circuit protector - error memory 33
fig. 47: Diagnosis circuit protector - trip counter 34
fig. 48: Diagnosis circuit protector - trip reason 34
fig. 49: Diagnosis circuit protector - operating voltage 34
fig. 50: Diagnosis circuit protector - device temperature 35
fig. 51: Diagnosis circuit protector - internal communication 35
fig. 52: Structure index bar chart circuit protector 36
fig. 53: Storage range of the bar chart data 36

10.2 Technical data

For the technical data of CPC10PB please see relevant data sheet.

10.3 Subject index

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